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RT2 COMBAT SAMPLES

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13. ABSTRACT *(Maximum 200 Words)*

Modeling the Illustrative Planning Scenario – Regional Threat 2 (IPS RT2) in theater-level models requires combat samples from the Combat Sample Generator (COSAGE) Model. The Center for Army Analysis (CAA) developed these combat samples in response to a request from the Air Force Studies and Analysis Agency (AFSAA) for use in the theater-level THUNDER model.

These combat samples reflect the results obtained from fighting stylized divisions, proportionally representing the theater forces, in several different attack/defend postures. Verification, validation, and quality assurance were conducted on the samples, ranging from theater-level attrition levels to specific system on system performance.

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RT2 COSAGE BOARDS

SUMMARY

THE PROJECT PURPOSE was to develop combat samples that reflect the US, Allied, and Threat forces in Illustrative Planning Scenario Regional Threat 2 (IPS RT2).

THE PROJECT SPONSOR was the Commander, Air Force Studies and Analysis Agency (AFSAA).

THE PROJECT OBJECTIVES were to:

(1) Adequately reflect force structure and equipment.

(2) Adequately reflect doctrinal missions.

(3) Adequately reflect system-level performance.

THE SCOPE OF THE PROJECT is the IPS RT2 scenario.

THE MAIN ASSUMPTION was that the Combat Sample Generator (COSAGE) Model stylized division adequately represents the theater for in-combat samples.

THE PRINCIPAL FINDING is that COSAGE IPS RT2 boards' combat samples adequately model the scenario.

THE PRINCIPAL RECOMMENDATIONS are to:

(1) Verify the combat samples in the Concepts Evaluation Model (CEM).

(2) Provide the combat samples to AFSAA.

(3) Provide the combat samples to the Office of the Secretary of Defense (OSD), when requested.

THE PROJECT EFFORT was conducted by MAJ Mike Mahony and CPT Rob Shearer, Operational Capability Assessments - Northeast Asia, Center for Army Analysis (CAA).

COMMENTS AND QUESTIONS may be sent to the Director, Center for Army Analysis, ATTN: CSCA-NE, 6001 Goethals Road, Suite 102, Fort Belvoir, VA 22060-5230.

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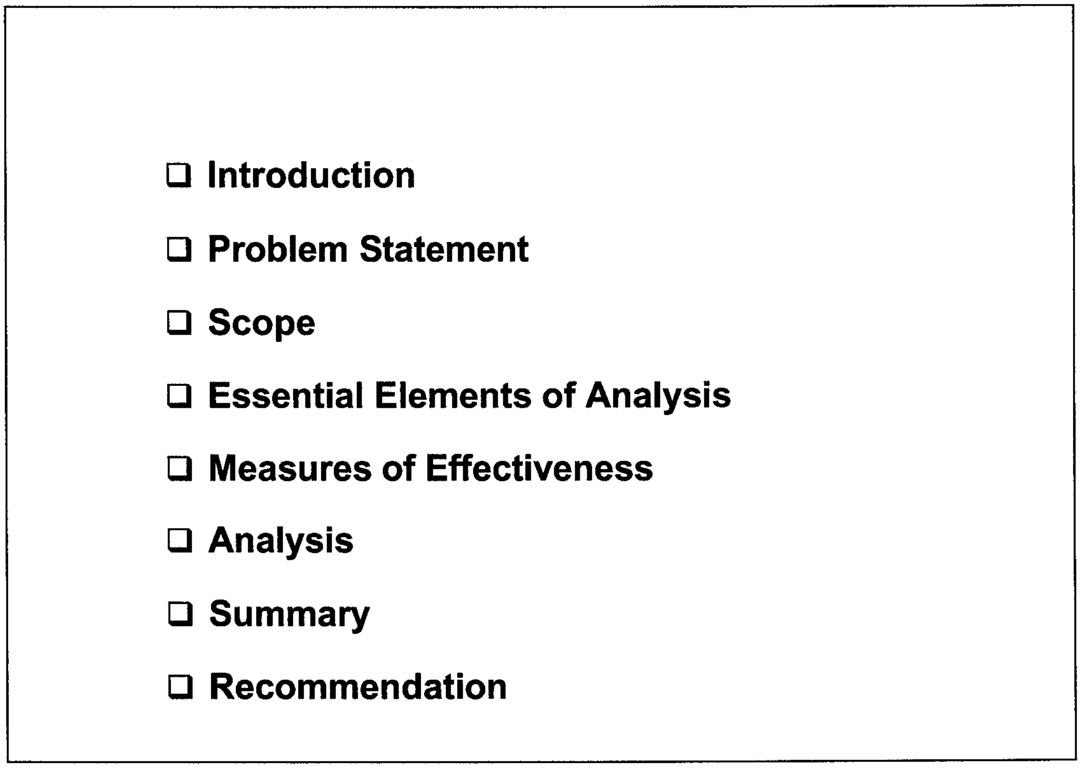
1 INTRODUCTION

MAJ Mike Mahony and CPT Rob Shearer, Operational Capability Assessments - Northeast Asia (OCA-NEA), jointly created the RT2 COSAGE boards. MAJ Mahony developed the US force files, CPT Shearer developed the Allied force files, and both developed the Threat force files. The RT2 boards do not include any of the transformations to the US Army proposed by the Chief of Staff of the Army (CSA).

1.1 AGENDA

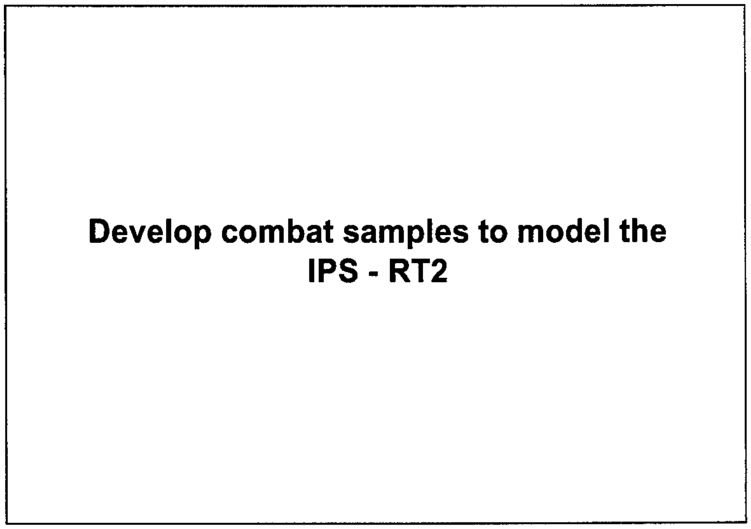


- ☐ **Introduction**
- ☐ **Problem Statement**
- ☐ **Scope**
- ☐ **Essential Elements of Analysis**
- ☐ **Measures of Effectiveness**
- ☐ **Analysis**
- ☐ **Summary**
- ☐ **Recommendation**

Figure 1. Agenda

Figure 1 presents the agenda followed for this report.

1.2 Problem Statement

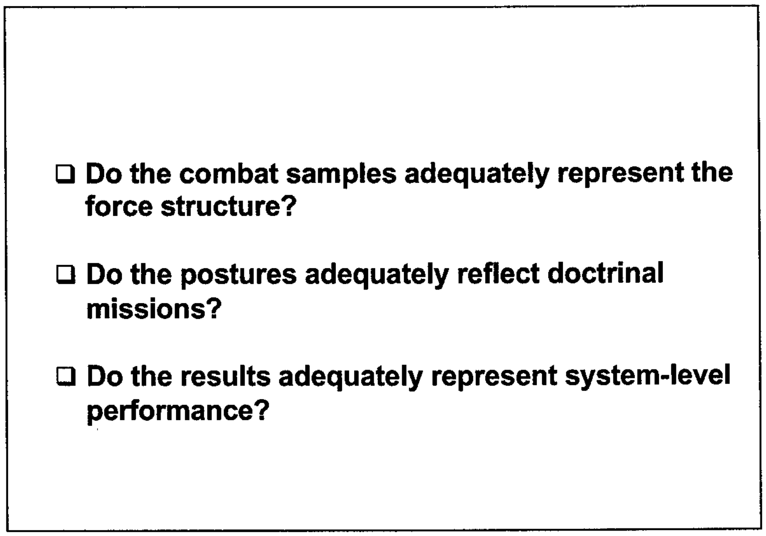


Develop combat samples to model the IPS - RT2

Figure 2. Problem Statement

The problem statement is as shown in Figure 2 above.

1.3 Essential Elements of Analysis

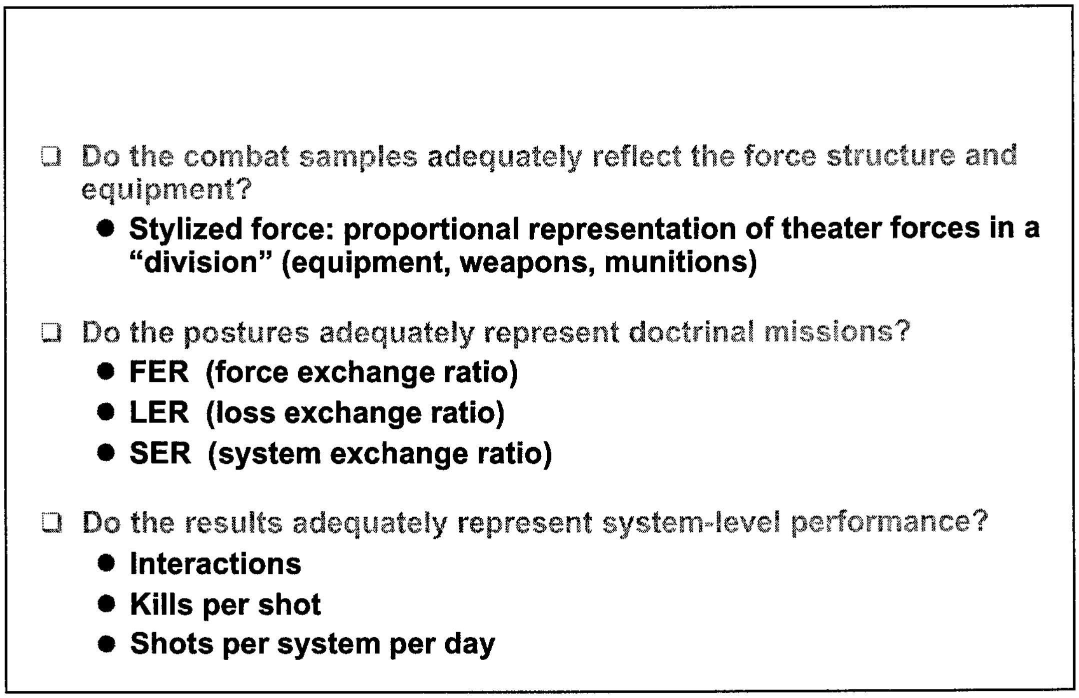


- ☐ **Do the combat samples adequately represent the force structure?**
- ☐ **Do the postures adequately reflect doctrinal missions?**
- ☐ **Do the results adequately represent system-level performance?**

Figure 3. Essential Elements of Analysis

Figure 3 presents the standard Combat Sample Generator (COSAGE) essential elements of analysis (EEA).

1.4 Measures of Effectiveness for Essential Elements of Analysis



- ☐ Do the combat samples adequately reflect the force structure and equipment?
  - **Stylized force: proportional representation of theater forces in a "division" (equipment, weapons, munitions)**
- ☐ Do the postures adequately represent doctrinal missions?
  - **FER (force exchange ratio)**
  - **LER (loss exchange ratio)**
  - **SER (system exchange ratio)**
- ☐ Do the results adequately represent system-level performance?
  - **Interactions**
  - **Kills per shot**
  - **Shots per system per day**

Figure 4. Measures of Effectiveness for Essential Elements of Analysis

Figure 4 lists the standard COSAGE measures of effectiveness for the essential elements of analysis.

1.5 Analysis

☐ Study Evolution
☐ Input Data Analysis
☐ Output Data Analysis
☐ Summary
☐ Recommendation

Figure 5. Analysis

Figure 5 above indicates the standard COSAGE analysis methodology.

1.6 Study Evolution

Study Evolution

☐ **TAA-07- RT2 changes**
  - **Forces**
    - ✓ **New Threat force**
    - ✓ **Updated US, Allied forces**
  - **Model**
    - ✓ **Updated weapon rates of fire**
    - ✓ **Updated SSPK files**

Figure 6. Study Evolution

Total Army Analysis-2007 Northeast Asia (TAA-07 NEA) was utilized as the base case from which the RT2 files were created. TAA-07 NEA US and Allied forces closely resemble the same forces in RT2. These forces were modified to match the forecast RT2 theater forces. RT2 also included COSAGE Model changes that were not included in the TAA-07 NEA boards. These include new single shot probability of kill (SSPK) files and updated weapon rates of fire.

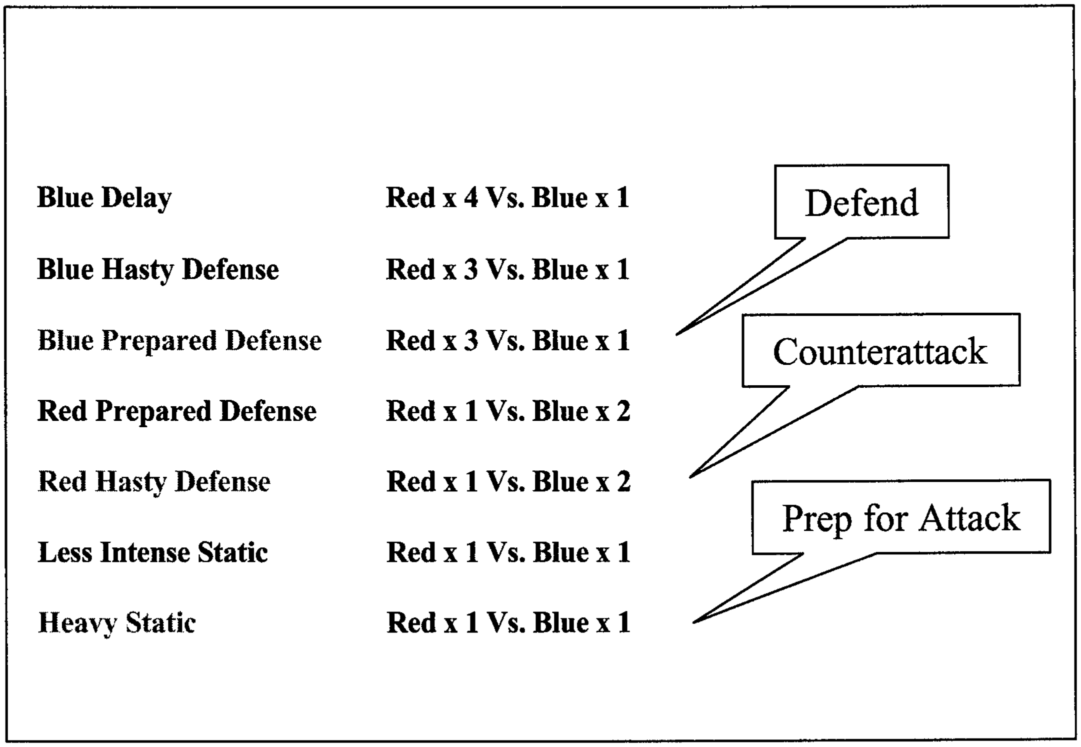
1.7 Input Data Analysis

- ❑ Force postures
- ❑ Major weapon system highlights
  - ● US
  - ● Allied
  - ● Red
- ❑ Major weapon system quantities
  - ● US
  - ● Allied
  - ● Red

Figure 7. Input Data Analysis

Input data analysis shown in Figure 7 focused on relating COSAGE postures to the RT2 concept of operations as well as significant major weapon systems of all forces.

1.8 Force Postures vs IPS RT2

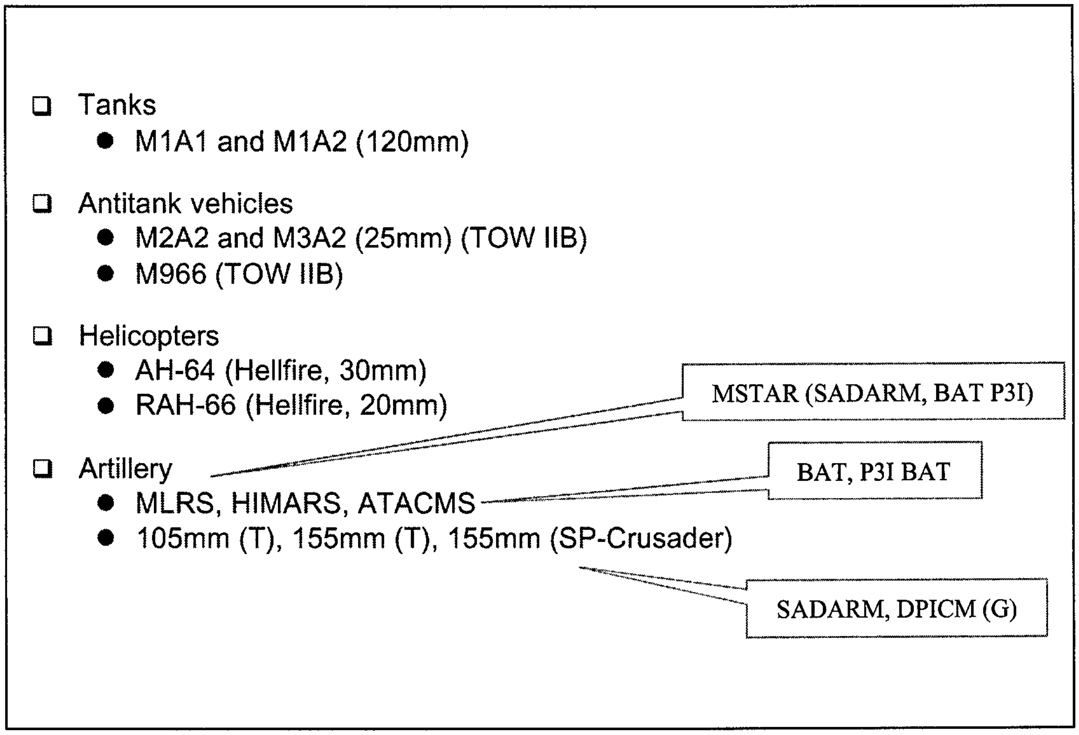


Blue Delay	**Red x 4 Vs. Blue x 1**	
Blue Hasty Defense	**Red x 3 Vs. Blue x 1**	
Blue Prepared Defense	**Red x 3 Vs. Blue x 1**	Defend
Red Prepared Defense	**Red x 1 Vs. Blue x 2**	
Red Hasty Defense	**Red x 1 Vs. Blue x 2**	Counterattack
Less Intense Static	**Red x 1 Vs. Blue x 1**	
Heavy Static	**Red x 1 Vs. Blue x 1**	Prep for Attack

Figure 8. Force Postures vs IPS RT2

COSAGE boards contain seven postures, and these seven fall into three categories--Blue attack, static, and Blue defend. Analysis for RT2 focused on one posture from each category, as highlighted in Figure 8 above.

1.9 US Major Weapon Systems Highlights



- ☐ Tanks
  - ● M1A1 and M1A2 (120mm)
- ☐ Antitank vehicles
  - ● M2A2 and M3A2 (25mm) (TOW IIB)
  - ● M966 (TOW IIB)
- ☐ Helicopters
  - ● AH-64 (Hellfire, 30mm)
  - ● RAH-66 (Hellfire, 20mm)
- ☐ Artillery
  - ● MLRS, HIMARS, ATACMS
  - ● 105mm (T), 155mm (T), 155mm (SP-Crusader)

MSTAR (SADARM, BAT P3I)

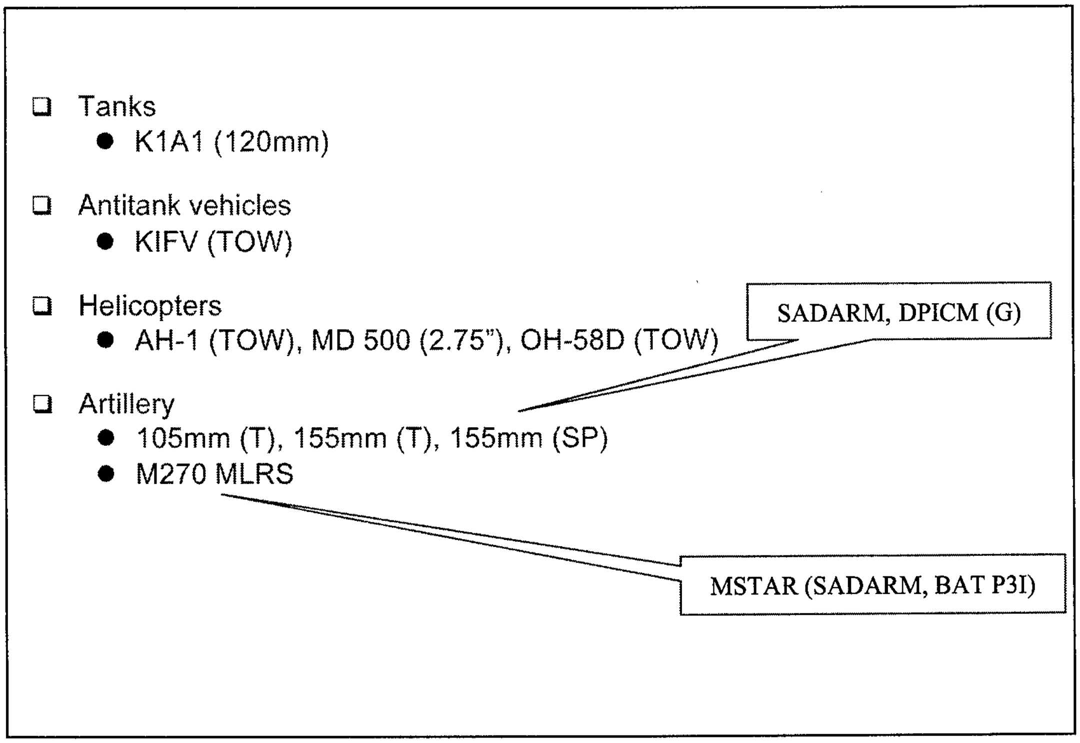
BAT, P3I BAT

SADARM, DPICM (G)

Figure 9. US Major Weapon Systems Highlights

The major additions to the US force in RT2 from TAA-07 NEA were the precision guided munitions (PGM) added to the multiple launch rocket system (MLRS), High Mobility Artillery Rocket System (HIMARS), Army Tactical Missile System (ATACMS), and 155mm howitzers.

1.10 Allied Major Weapon Systems Highlights



☐ Tanks
  - K1A1 (120mm)

☐ Antitank vehicles
  - KIFV (TOW)

☐ Helicopters
  - AH-1 (TOW), MD 500 (2.75"), OH-58D (TOW)

☐ Artillery
  - 105mm (T), 155mm (T), 155mm (SP)
  - M270 MLRS

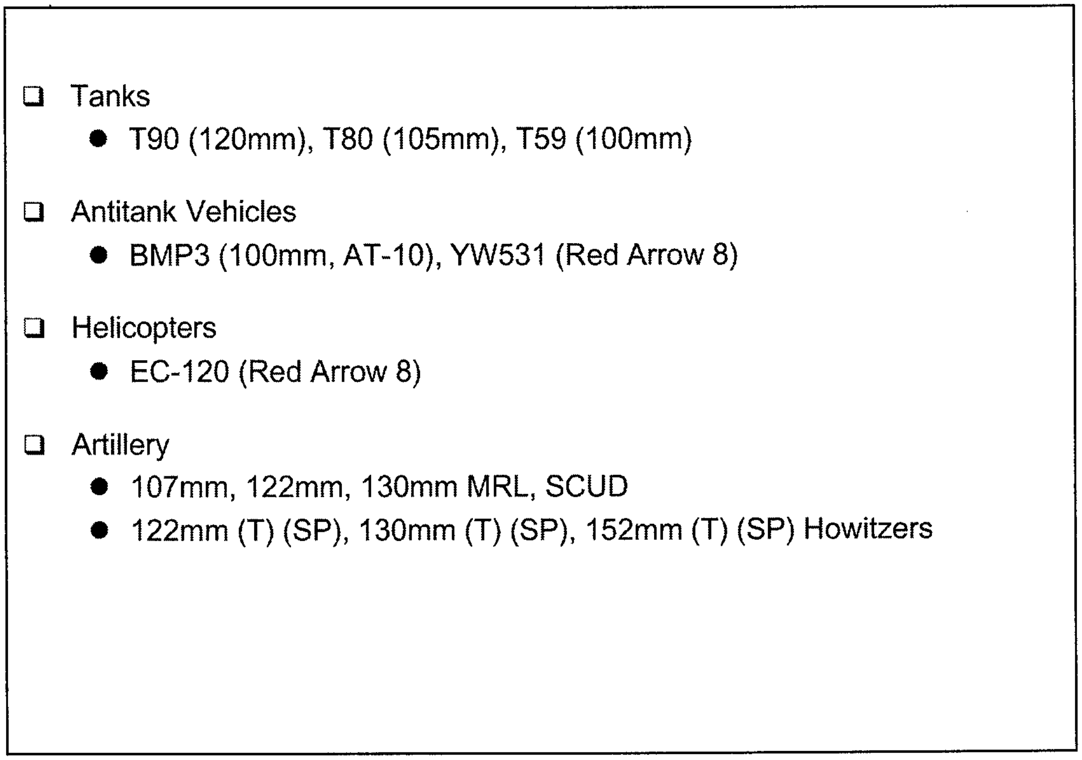
SADARM, DPICM (G)

MSTAR (SADARM, BAT P3I)

Figure 10. Allied Major Weapon Systems Highlights

The major additions to the Allied force in RT2 from TAA-07 NEA were the precision guided munitions added to MLRS and 155mm howitzers.

1.11 Threat Major Weapon Systems Highlights



☐ Tanks
- T90 (120mm), T80 (105mm), T59 (100mm)

☐ Antitank Vehicles
- BMP3 (100mm, AT-10), YW531 (Red Arrow 8)

☐ Helicopters
- EC-120 (Red Arrow 8)

☐ Artillery
- 107mm, 122mm, 130mm MRL, SCUD
- 122mm (T) (SP), 130mm (T) (SP), 152mm (T) (SP) Howitzers

Figure 11. Threat Major Weapon Systems Highlights

Threat forces in RT2 and TAA-07 NEA are significantly different--RT2 Threat forces are more mobile as well as more modern.

1.12 US Major Weapon Systems Quantities

US	System	TAA-07	RT2
Tanks			
	M1A1	**120**	**10**
	M1A2	**128**	**237**
AT			
	M2A3	**204**	**191**
	M3CFV	**36**	**62**
	HMMWV TOW IIB	**50**	**61**
Helicopters			
	AH-64	**54, 12 (L)**	**29, 17 (L)**
	RAH-66	**0**	**18**
Artillery			
	105mm (T)	**30**	**22**
	155mm (T)	**48**	**13**
	155mm (SP)	**24, 60 (Paladin)**	**97 (Crusader)**
	HIMARS	**0**	**24**
	MLRS	**72**	**31**
	ATACMS	**9**	**9**

Figure 12. US Major Weapon Systems Quantities

US systems in RT2 are similar to those in TAA-07 NEA, with some modernization, as shown in Figure 12.

1.13 Allied Major Weapon Systems Quantities

ROK	System	TAA-07	RT2
Tanks			
	K1A1	**224**	**203**
AT			
	KIFV-TOW	**70**	**263**
Helicopters			
	AH-1S	**9**	**15**
	MD 500	**12**	**24**
	OH-58D	**6**	**8**
	AH-64A	**8**	**0**
Artillery			
	105mm (T)	**64**	**20**
	155mm (T)	**160**	**60**
	155mm (SP)	**112, 20 (Paladin)**	**224**
	MLRS M270	**12**	**44**

Figure 13. Allied Major Weapon Systems Quantities

Allied forces in RT2, shown in Figure 13, are also similar to those in TAA-07 NEA, with some modernization.

1.14 Threat Major Weapon Systems Quantities

Threat	System	TAA-07	RT2
Tanks			
	T55 / T59	**65**	**182**
	T62 / T80	**52**	**40**
	T62C / T90	**39**	**78**
AT			
	M1973 / BMP3	**90**	**92**
	M1992 / YW531	**24**	**120**
Helos			
	Hoplite / EC-120	**18**	**5**
	MD 500	**12**	**0**
Artillery			
	107 MRL	**56**	**6**
	122 MRL	**48**	**17**
	130 MRL	**0**	**43**
	122mm (T)	**0**	**149**
	122mm (SP)	**126**	**23**
	130mm (T)	**64**	**50**
	152mm (SP)	**120**	**12**
	170mm (SP)	**24**	**35**
	SCUDS	**9**	**27**

Figure 14. Threat Major Weapon Systems Quantities

Threat systems differ greatly from TAA-07 NEA to RT2, as shown in Figure 14. Systems separated above by a slash show the TAA-07 system on the left and the RT2 system on the right, e.g., T55s fought in TAA-07, T59s fought in RT2.

1.15 Output Data Analysis

- ❑ **Defend**
  - **Allied systems**
    - ✓ **K1A1 120mm cannon**
    - ✓ **KIFV TOW IIA**
  - **US systems**
    - ✓ **AH-64A / AH-64D Hellfire**
    - ✓ **RAH-66 Hellfire**
  - **Threat systems**
    - ✓ **T90 125mm cannon**
    - ✓ **BMP3 100mm cannon**

- ❑ **Counterattack**
  - **US systems**
    - ✓ **M1A1 / M1A2 120mm cannon**
    - ✓ **M2A3 BFV TOW IIB**
    - ✓ **AH-64A / AH-64D Hellfire**
    - ✓ **RAH-66 Hellfire**
  - **Threat systems**
    - ✓ **T80 105mm cannon**
    - ✓ **YW531 Red Arrow 8**

Figure 15. Output Data Analysis

Output data analysis focused on significant US, Allied, and Threat systems in the defend and counterattack phases of the operation, as shown in Figure 15 above.

1.16 Output Data Analysis (continued)

☐ **US indirect fire engagements**

☐ **FER / LER comparisons**

☐ **Kills by systems**

Figure 16. Output Data Analysis (continued)

Output data analysis also focused on US indirect fire engagements, force/system performance ratios, and percentage of kills by systems.

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2 THE DEFEND PHASE

2.1 Allied: KM1A1 (120mm)

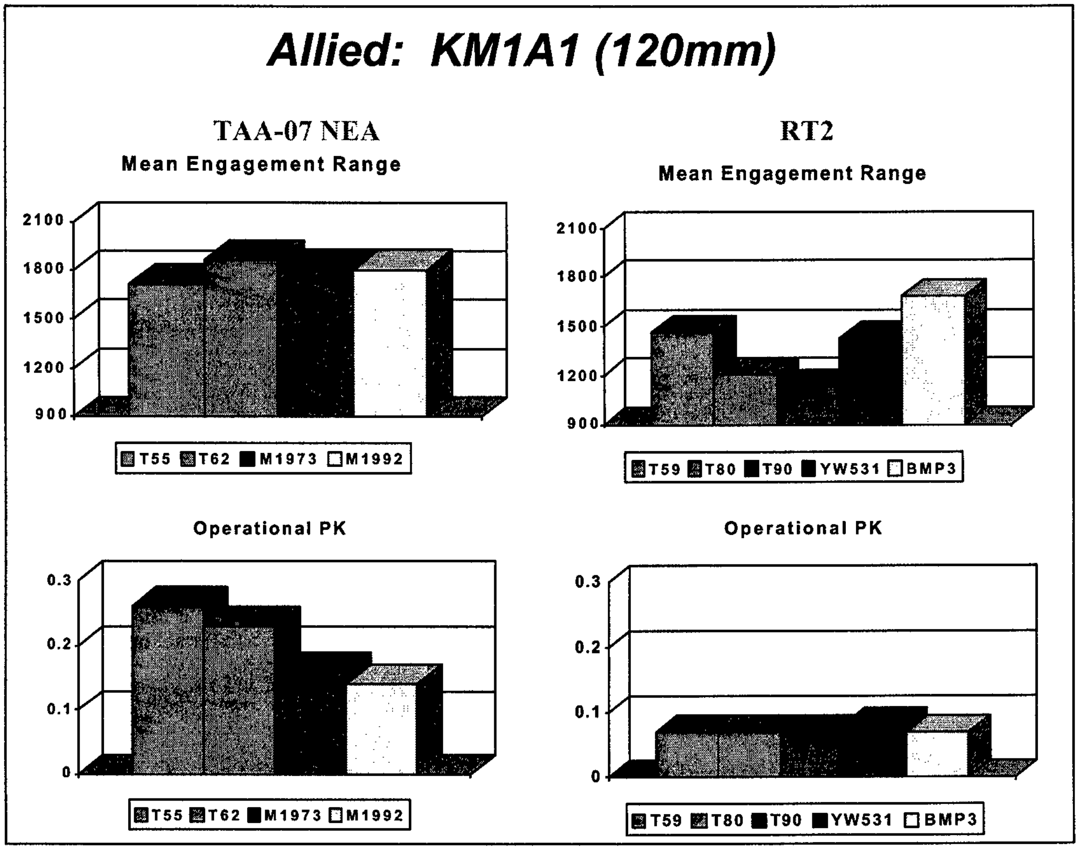


Figure 17. Allied: KM1A1 (120mm)

Analysis of the defend phase begins with the Allied KM1A1 tank as shown in Figure 17. The same system exists in both TAA-07and RT2, but the systems that it targets differ by study. Mean engagement ranges decreased for the KM1A1 due to the minimum SSPK function used in RT2. The expected increase in operational PKs for RT2 failed to occur for two reasons: (1) updated weapon rates of fire from TAA-07 to RT2, leading to a higher number of hits on dead targets, and (2) more advanced systems in RT2.

2.2 Allied: KIFV (TOW IIA)

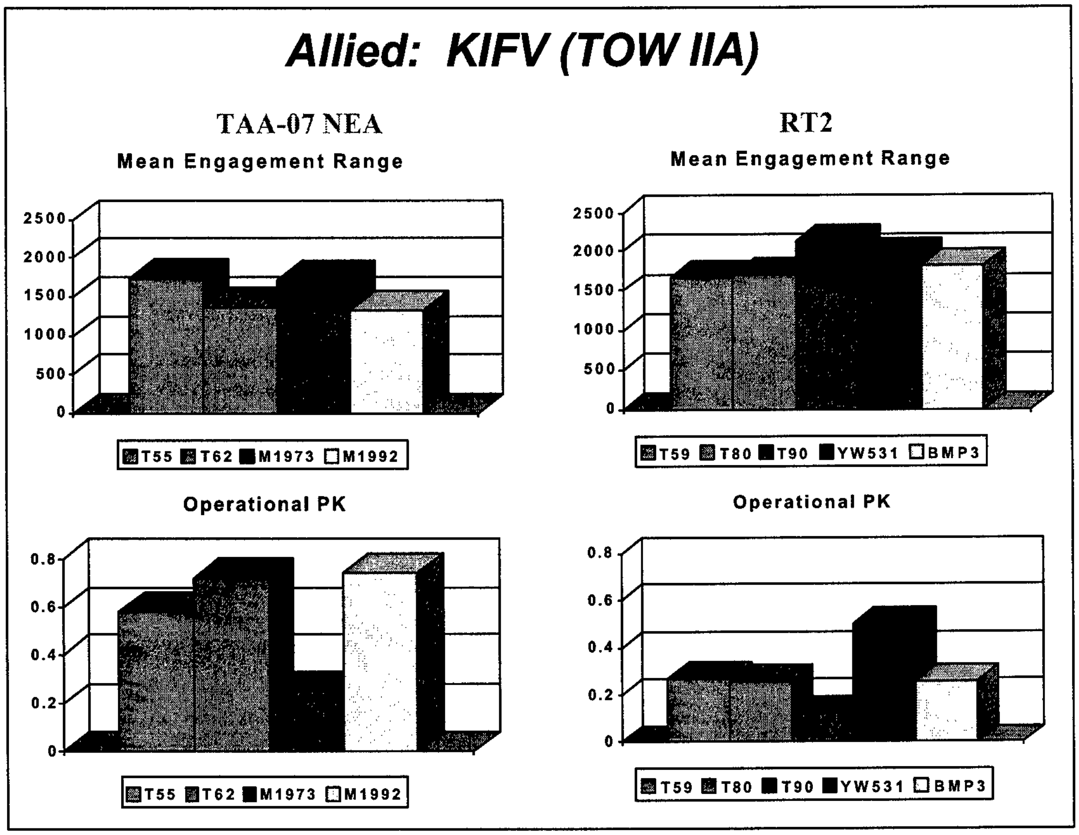


Figure 18. Allied: KIFV (TOW IIA)

The defend phase analysis continues with the Allied Korean infantry fighting vehicle (KIFV) (TOW IIA). The same system exists in both TAA-07and RT2, but the systems that it targets differ by study. Mean engagement ranges changed little in response to the minimum SSPK function used in RT2, since the TOW IIA SSPK curve is relatively flat. Operational PKs decreased due to updated tube-launched, optically tracked, wire-guided (TOW) missile SSPK values for RT2 that were only 70 percent of the TAA-07values.

2.3 US: AH-64D (Hellfire)

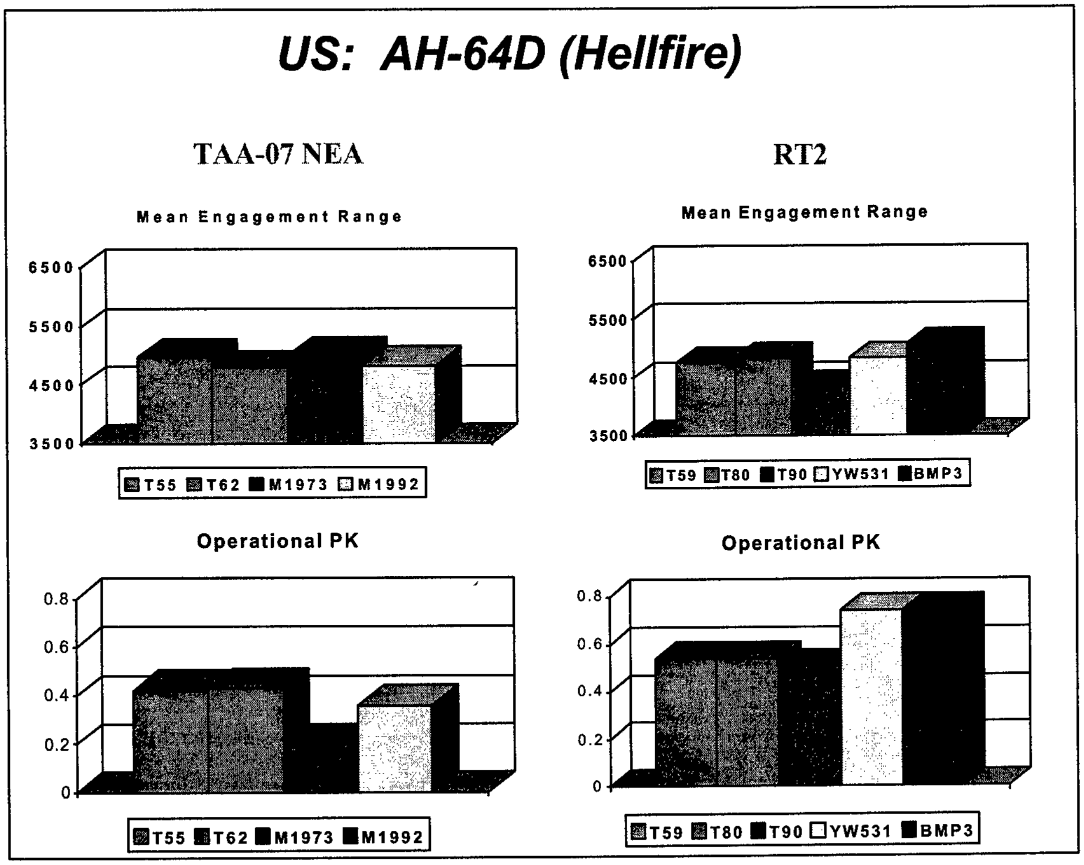


Figure 19. US: AH-64D (Hellfire)

The next system addressed in the analysis of the defend phase is the US Apache Longbow. The same system exists in both TAA-07 and RT2, but the systems that it targets differ by study. Mean engagement ranges changed little in response to the minimum SSPK function used in RT2, since the Hellfire SSPK curve is relatively flat. Operational PKs increased due to the new improved aviation algorithm incorporated into the COSAGE Model in January 2000.

2.4 US: RAH-66 (Hellfire)

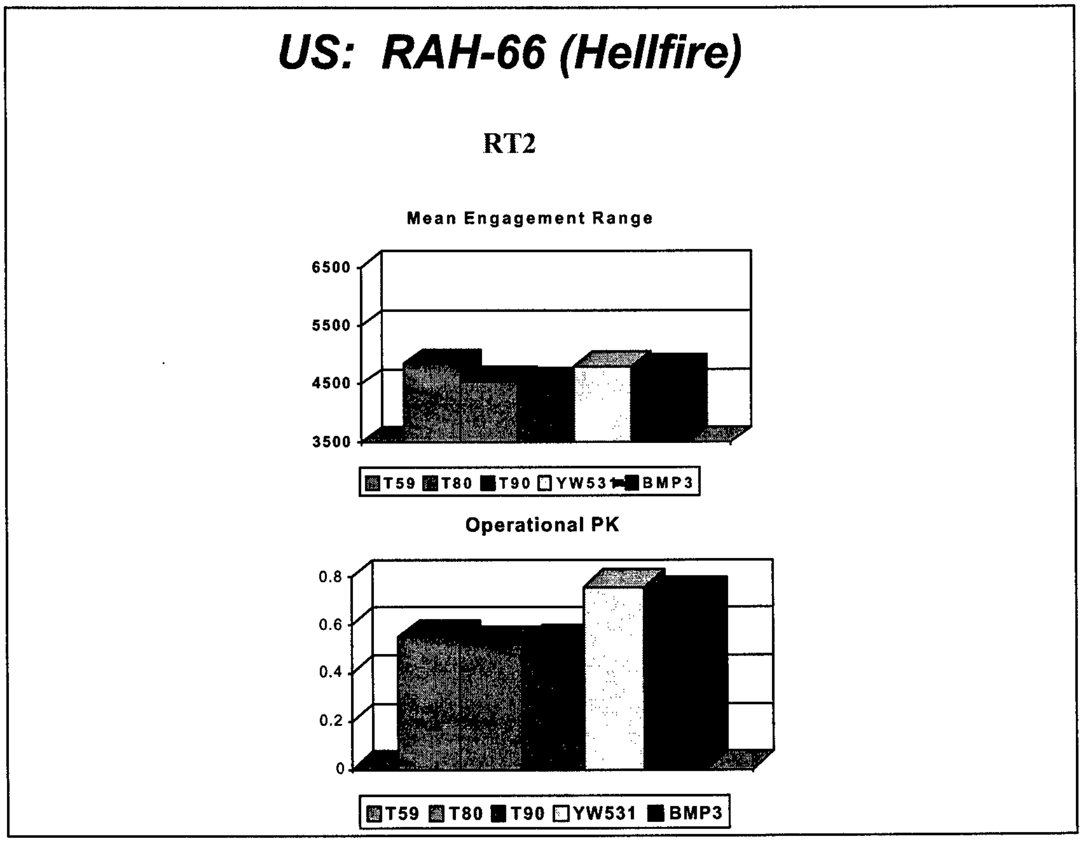


Figure 20. US: RAH-66 (Hellfire)

Analysis of the defend phase continues with the US Comanche. This system does not exist in TAA-07, and no similar counterpart exists. Mean engagement ranges and operational PKs are similar to those of the Apache on Figure 19, as expected.

2.5 Threat: T62 (105mm)T90 (125mm)

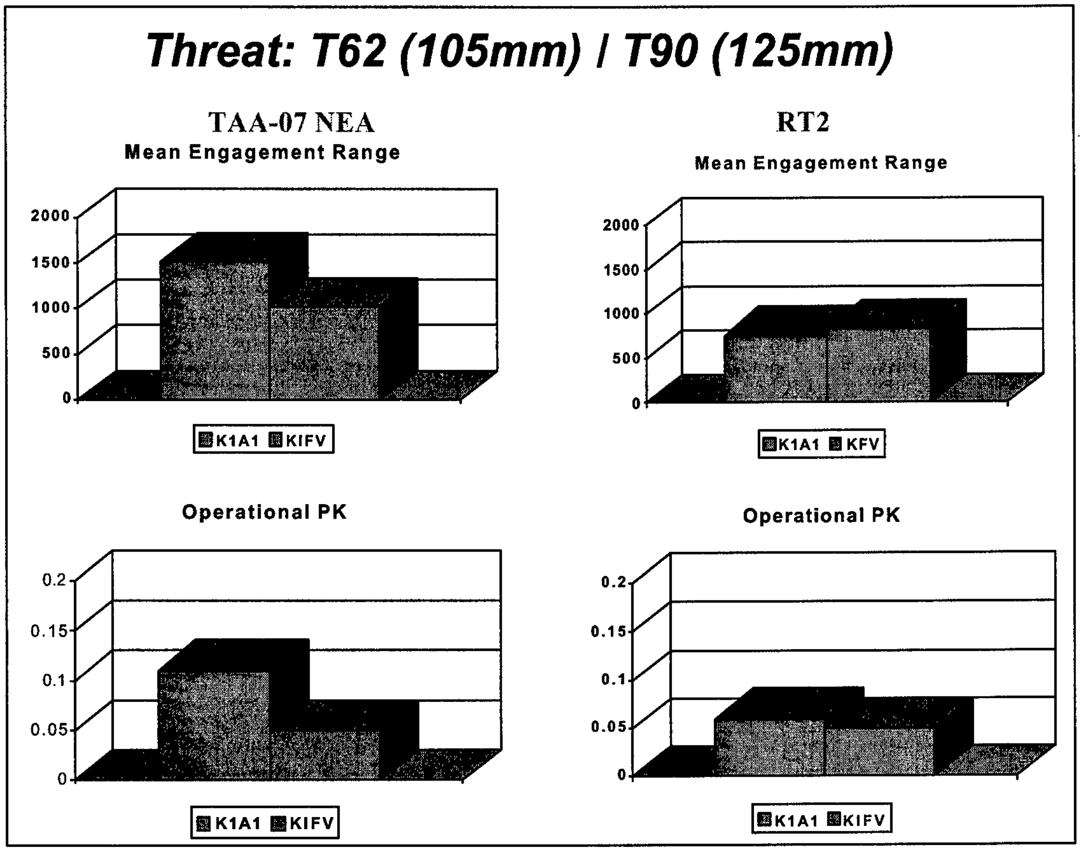


Figure 21. Threat: T62 (105mm)/T90 (125mm)

The Threat T90 tank is the next system examined in the defend phase. The same system does not exist in TAA-07. Comparisons are made against the T62, the best Threat tank in TAA-07. Mean engagement ranges decreased due to the minimum SSPK function used in RT2. The expected increase in operational PKs for RT2 failed to occur due to the updated weapon rates of fire, leading to a higher number of hits on dead targets.

2.6 Red: M1992 (AT3)/BMP3 (100mm)

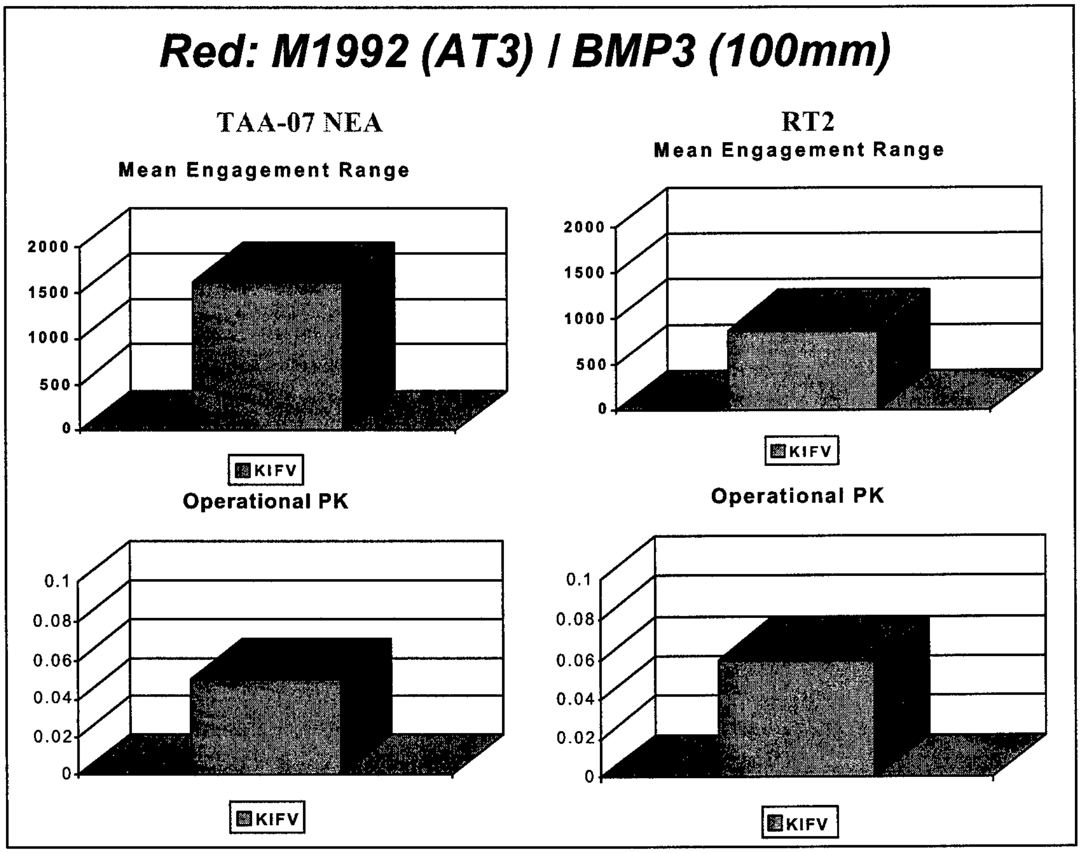


Figure 22. Red: M1992 (AT3)/BMP3 (100mm)

The defend phase analysis continues with the Threat BMP3 (100mm). The same system does not exist in TAA-07. Comparisons are made against the M1992, the best Threat IFV in TAA-07. Mean engagement ranges decreased due to the minimum SSPK function used in RT2. Operational PKs increase due to closer engagement ranges and higher SSPKs for the BMP3.

3 COUNTERATTACK

3.1 US: M1A2 (120mm)

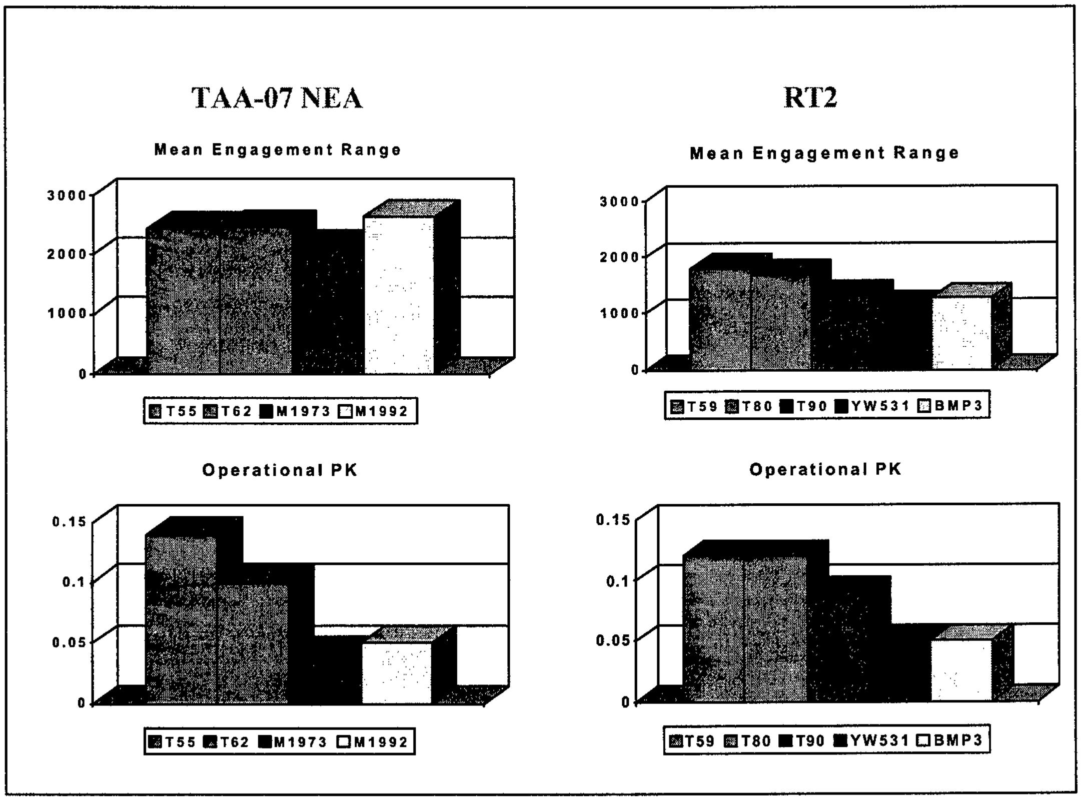


Figure 23. US: M1A2 (120mm)

Analysis of the counterattack phase begins with the US M1A2 tank (Figure 23). The same system exists in both TAA-07 and RT2, but the systems that it targets differ by study. Mean engagement ranges decreased for the M1A2 due to the minimum SSPK function used in RT2. The expected increase in operational PKs for RT2 was dampened by two factors: (1) updated weapon rates of fire from TAA-07 to RT2, leading to a higher number of hits on dead targets, and (2) more advanced systems in RT2.

3.2 US: M2A3 (TOW IIB)

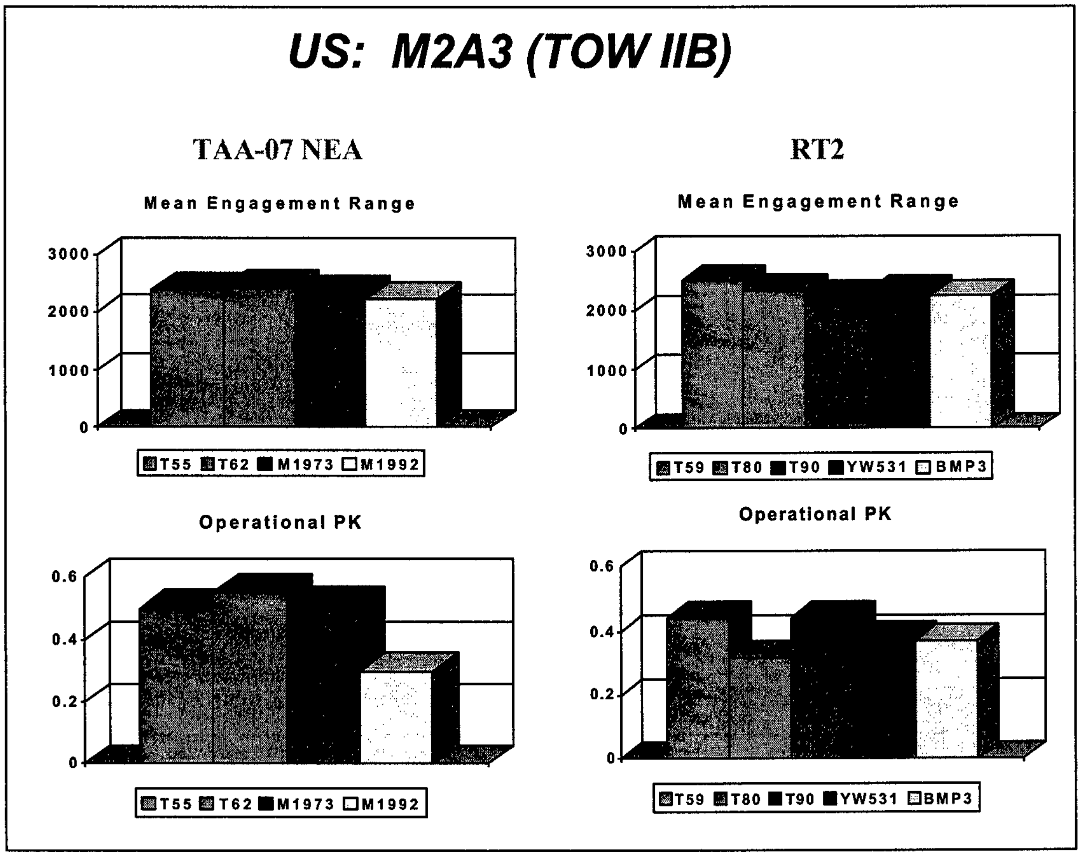


Figure 24. US: M2A3 (TOW IIB)

Analysis of the counterattack phase continues with the US M2A3 (TOW IIB). The same system exists in both TAA-07 and RT2, but the systems that it targets differ by study. Mean engagement ranges changed little in response to the minimum SSPK function used in RT2 since the TOW IIA SSPK curve is relatively flat. Operational PKs decreased due to updated RT2 TOW SSPK values that were only 70 percent of the TAA-07 values.

3.3 US: AH-64D (Hellfire)

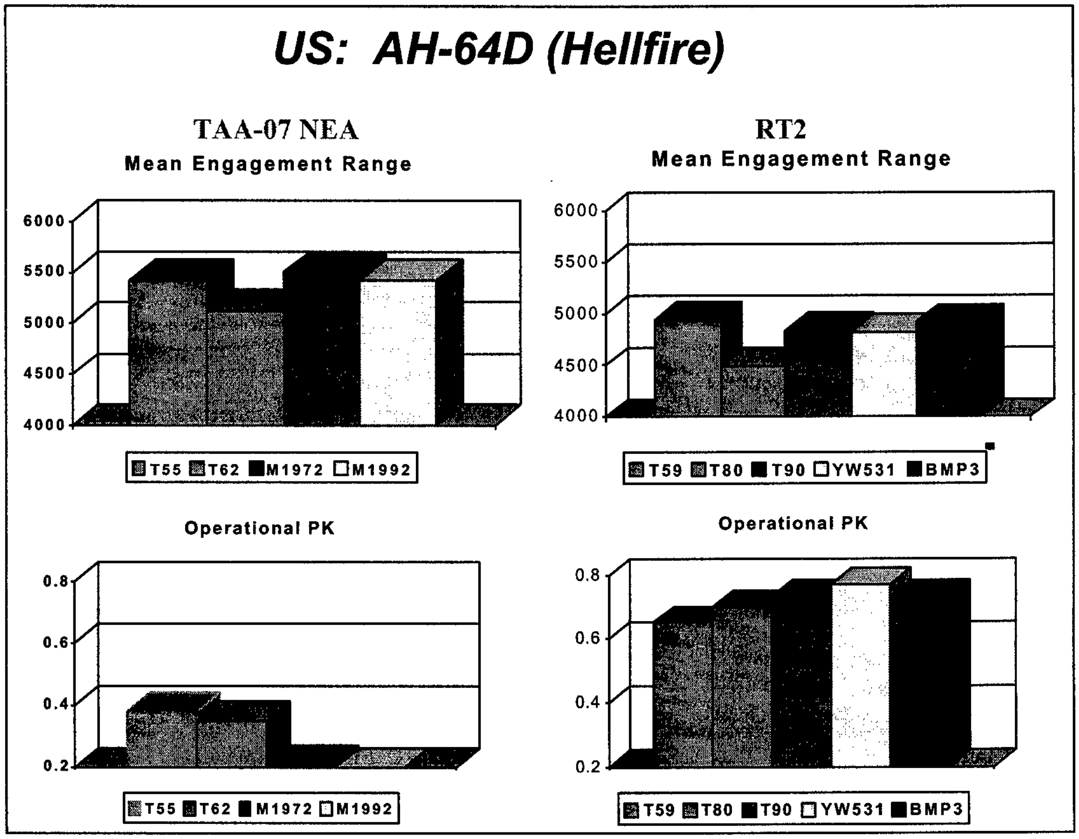


Figure 25. US: AH-64D (Hellfire)

The US Apache Longbow is the next system analyzed in the counterattack phase. The same system exists in both TAA-07 and RT2, but the systems that it targets differ by study. Mean engagement ranges changed little in response to the minimum SSPK function used in RT2, since the Hellfire SSPK curve is relatively flat. Operational PKs increased due to the improved aviation algorithm incorporated into the COSAGE Model in January 2000.

3.4 US: RAH-66 (Hellfire)

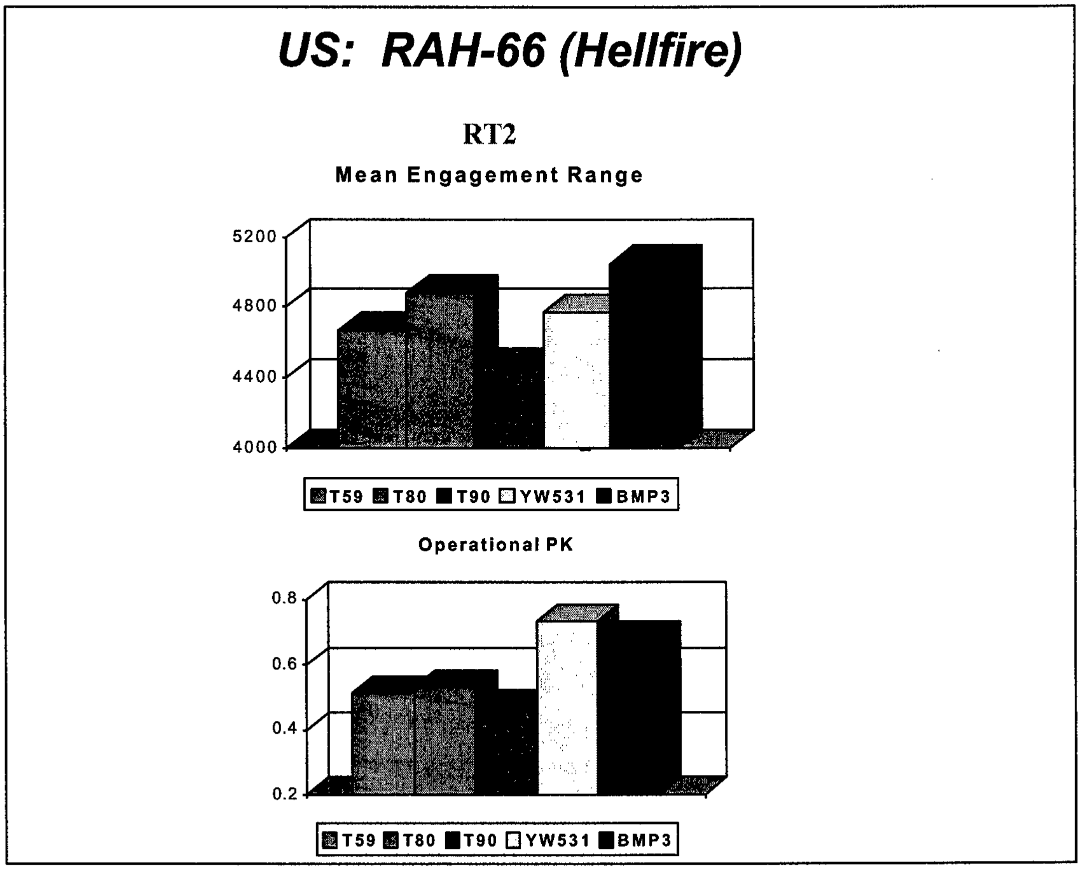


Figure 26. US: RAH-66 (Hellfire)

The counterattack phase continues with analysis of the US Comanche. This system does not exist in TAA-07, and no similar counterpart exists. Mean engagement ranges and operational PKs are similar to those of the Apache shown on Figure 25, as expected.

3.5 Red: T55 (100mm)/T80 (105mm)

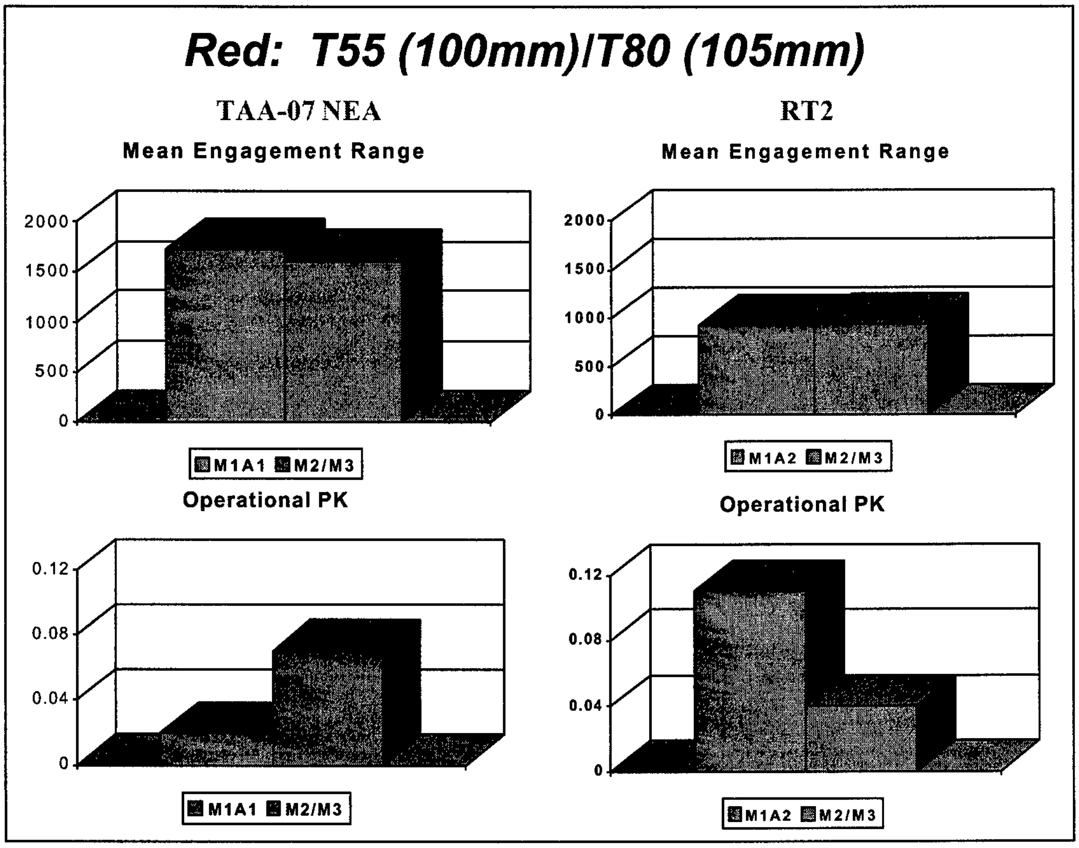


Figure 27. Red: T55 (100mm)/T80 (105mm)

Analysis of the counterattack phase continues with the Threat T80 tank. This system does not exist in TAA-07, so comparisons are made against the T55. Mean engagement ranges decreased due to the minimum SSPK function used in RT2. Operational PKs increased due to higher SSPKs and smaller mean engagement ranges for the T80.

3.6 Red: M1974\3 (AT3)/YW 531 (RA 8)

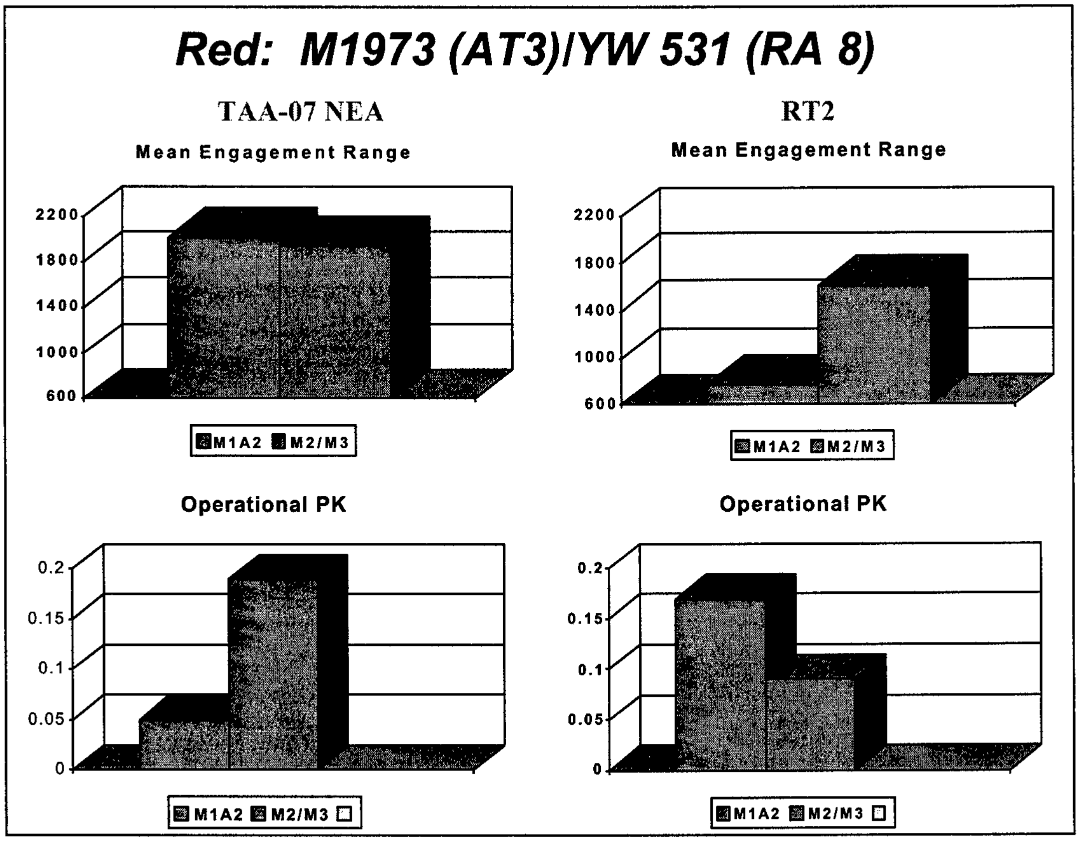


Figure 28. Red: M1973 (AT3)/YW 531 (RA 8)

Data for the counterattack phase continues with the Threat YW 531 (Red Arrow 8 ATGM). The same system does not exist in TAA-07, so comparisons are made against the M1973, which also carries an antitank guided missile (ATGM) (AT3). Mean engagement ranges decreased due to the minimum SSPK function used in RT2. Operational PKs remained unchanged since updated rates of fire cancelled out higher SSPKs.

3.7 US Indirect Fire (rounts/tube/day)

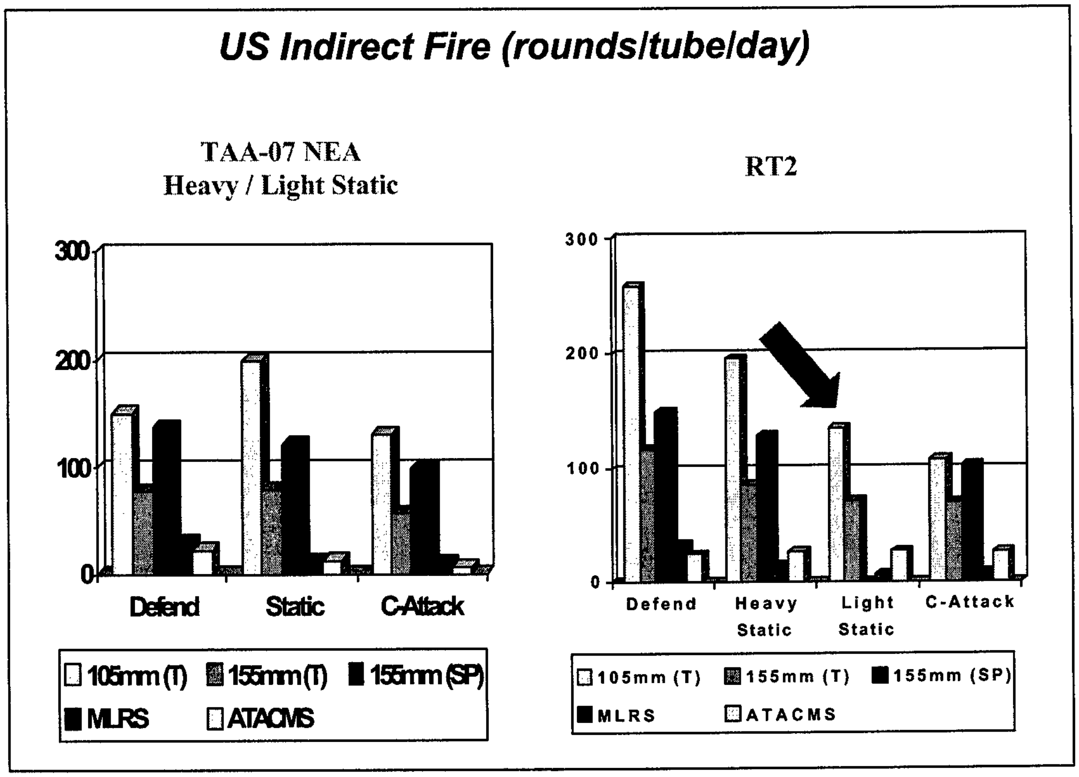


Figure 29. US Indirect Fire (rounds/tube/day)

Rates of fire for US indirect fire systems remain relatively constant from TAA-07 to RT2. The new systems in RT2 included Crusader and HIMARS. The new munitions in RT2 included MSTAR1/MSTAR 2 for the MLRS/HIMARS, brilliant antitank (BAT)/BAT2 for ATACMS, and sense and destroy armor (SADARM) for the Crusader. Preplanned artillery targets were removed from the RT2 light static posture, reducing the number of artillery rounds fired.

3.8 LER Comparison

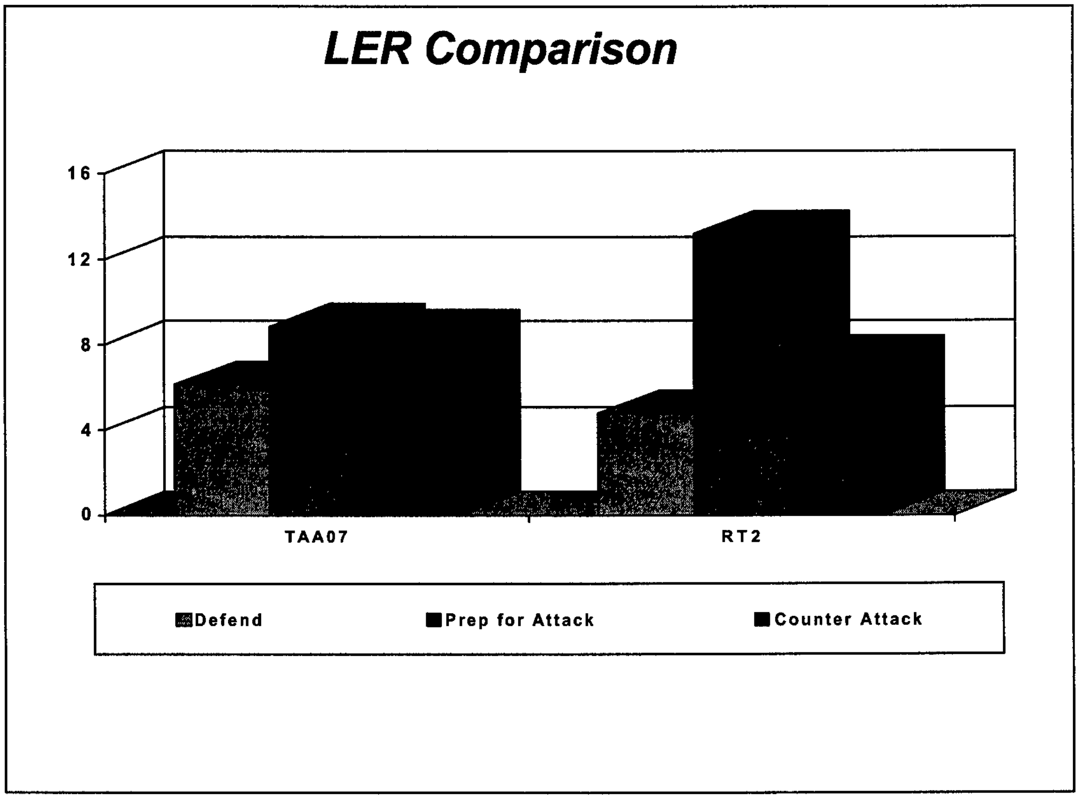


Figure 30. LER Comparison

As shown in Figure 30, LER patterns remained constant across both studies.

3.9 FER Comparison

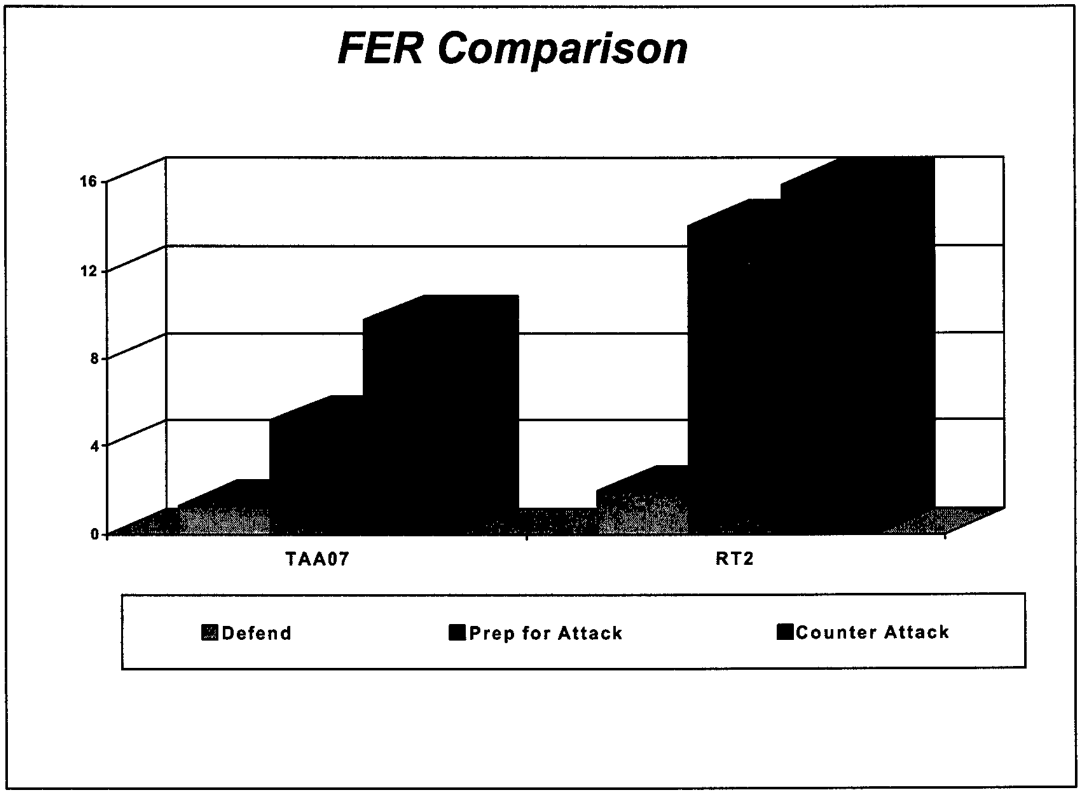


Figure 31. FER Comparison

FER patterns remained constant across both studies, as shown in Figure 31 above.

3.10 Kills by System

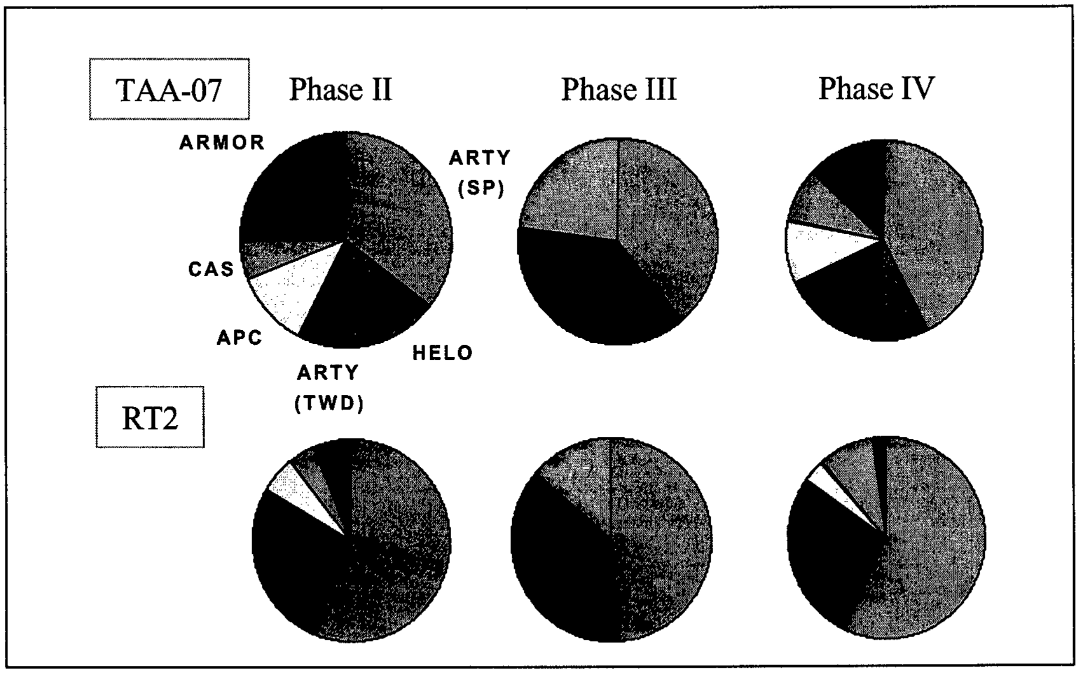
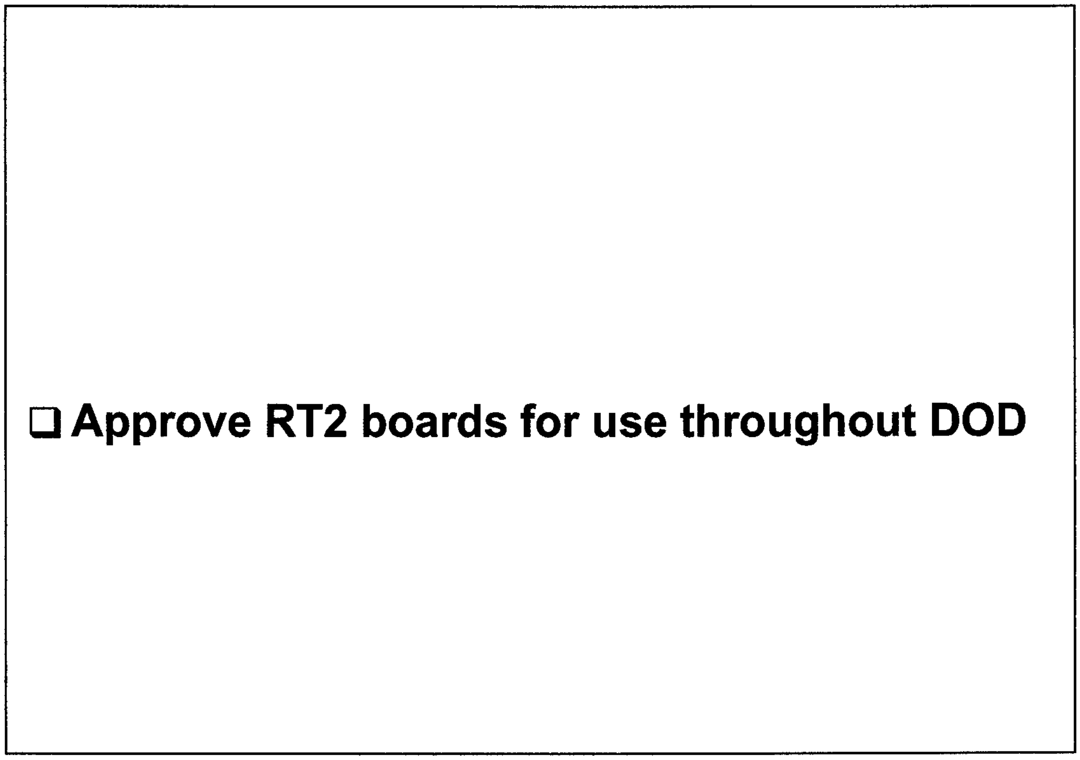


Figure 32. Kills by System

The addition of the PGMs in RT2 led to an increased percentage of kills by artillery systems. These gains came largely from TAA-07 NEA armor kills that the antitank PGMs "stole" in RT2. Increased lethality in attack aviation prevented "stealing" of attack aviation kills by artillery in RT2.

3.11 Recommendation



☐ Approve RT2 boards for use throughout DOD

Figure 33. Recommendation

Mr. E. B. Vandiver, Director, CAA, approved the release of RT2 boards on 7 April 2000.

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APPENDIX A. PROJECT CONTRIBUTORS

1. PROJECT TEAM

a. Project Directors

MAJ Mike Mahony and CPT Rob Shearer, Operational Capability Assessments - Northeast Asia

2. PRODUCT REVIEW

Mr. Ron Iekel, TQM Specialist

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APPENDIX B. REQUEST FOR ANALYTICAL SUPPORT

PART 1

Performing Division: NE *Account Number:* **97066**

Tasking: Verbal *Mode (Contract-Yes/No):* No

Acronym: **COSAGE-RT2** (originally NPSS-A)

Title: COSAGE Samples for RT2 (originally Near Peer Scenario Samples-Asia)

Start Date: 15-Jan-97 *Estimated Completion Date:* 15-May-00

Requestor/Sponsor (i.e., DCSOPS): DCSOPS *Sponsor Division:* ZD

Resource Estimates: ***a. Estimated PSM:*** 6 ***b. Estimated Funds:***

c. Models to be Used:

Description/Abstract:

Develop combat samples in support of Near Peer Scenario - Asia for QDR analysis.

Study Director/POC Signature: Original Signed *Phone#:* 301-295-1627

Study Director/POC: **MAJ James McMullin**

If this Request is for an External Project expected to consume 6 PSM or more Part 2 Information is Not Required. See TAB C of the Project Directors' Guide for preparation of a Formal Project Directive.

PART 2

Background:

Scope:

Issues:

Milestones:

Signatures ***Division Chief Signature:*** *Original Signed and Dated* ***Date:***

Division Chief Concurrence: Mr. Howard G. Whitley

Sponsor Signature: *Original Signed and Dated* ***Date:***

Sponsor Concurrence (COL/DA Div Chief/GO/SES) :

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